

What is claimed is:

1. A digital-watermark-embedding apparatus for embedding a digital watermark into a content, said digital-watermark-embedding apparatus comprising:

5 a picture input unit for inputting said content;

a vision-sensitivity computation unit and a digital-watermark embedment unit, which are connected to said picture input unit; and

a picture compression unit connected to said vision-sensitivity computation unit and said digital-watermark embedment unit;

10 wherein:

said vision-sensitivity computation unit creates a noise-vision-sensitivity index from a variance of luminance values of a block included in a picture frame received from said picture input unit and outputs said noise-vision-sensitivity index to said digital-watermark embedment unit and said picture compression

15 unit;

said digital-watermark embedment unit embeds said digital watermark into said picture frame by changing luminance values of each block included in said picture frame on the basis of said noise-vision-sensitivity index received from said vision-sensitivity computation unit, and outputs said picture frame

20 including said embedded digital watermark to said picture compression unit; and

said picture compression unit creates a quantization parameter on the basis of said noise-vision-sensitivity index received from said vision-sensitivity computation unit, and compresses said picture frame including said embedded digital watermark on the basis of said quantization parameter.

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2. A digital-watermark-embedding apparatus according to claim 1, further comprising a motion-searching unit connected to said picture input unit, connected to said digital-watermark embedment unit as well as connected to said picture compression unit;

5 wherein:

said motion-searching unit compares a specific block included in a picture frame received from said picture input unit with a block included in another picture frame received from said picture input unit to create a motion vector to be output to said digital-watermark embedment unit and said picture
10 compression unit;

said digital-watermark embedment unit embeds said digital watermark into said picture frame by changing luminance values of each block included in said picture frame on the basis of said noise-vision-sensitivity index received from said vision-sensitivity computation unit as well as said motion vector
15 received from said motion-searching unit, and outputs said picture frame including said embedded digital watermark to said picture compression unit; and

said picture compression unit creates a quantization parameter on the basis of said noise-vision-sensitivity index received from said vision-sensitivity computation unit, and compresses said picture frame including said embedded
20 digital watermark on the basis of said quantization parameter as well as said motion vector received from said motion-searching unit.

3. A digital-watermark-embedding apparatus according to claim 2 wherein:

25 said digital-watermark embedment unit includes a digital-watermark-

embedment control unit as well as a motion-vector buffer unit, a vision-sensitivity buffer unit and a picture buffer unit, which are connected to said digital-watermark-embedment control unit; and

said digital-watermark-embedment control unit executes control so as
5 to carry out a process of embedding a digital watermark into a picture frame after said motion vector is supplied to said motion-vector buffer unit, said noise-vision-sensitivity index is supplied to said vision-sensitivity buffer unit and said picture frame is supplied to said picture buffer unit.

10 4. A digital-watermark-embedding apparatus according to claim 3 further comprising a change-quantity computation unit connected to said motion-vector buffer unit and connected to said vision-sensitivity buffer unit, and a pixel-changing unit connected to said change-quantity computation unit and connected to said picture buffer unit;

15 wherein:

after said motion vector is supplied to said motion-vector buffer unit and said noise-vision-sensitivity index is supplied to said vision-index buffer unit, said digital-watermark-embedment control unit outputs said motion vector and said noise-vision-sensitivity index to said change-quantity computation unit for use in
20 computation of a pixel-change quantity; and

control is executed so as to carry out a process of embedding a digital watermark into a picture frame after said pixel-change quantity and said picture frame stored in said picture buffer unit are supplied to said pixel-changing unit.

25 5. A digital-watermark-embedding apparatus according to claim 2

wherein:

said picture compression unit includes a compression control unit as well as a motion-vector buffer unit, a vision-sensitivity buffer unit and a picture buffer unit, which are connected to said compression control unit; and

5 said compression control unit executes control so as to carry out a compression process after said motion vector is supplied to said motion-vector buffer unit, said noise-vision-sensitivity index is supplied to said vision-sensitivity buffer unit and a predetermined frame with blocks thereof including said embedded digital watermark is supplied to said picture buffer unit.

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6. A digital-watermark-embedding apparatus according to claim 2 wherein, if said input content is a static picture, said motion vector output by said motion-searching unit is set at a zero before being supplied to said digital-watermark embedment unit and said picture compression unit.

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7. A digital-watermark-embedding apparatus for embedding a digital watermark into an input content, said digital-watermark-embedding apparatus comprising:

20 an input unit for inputting a compressed and encoded picture as said content;

 a picture-decoding unit for carrying out a decoding process on said compressed and encoded picture received from said input unit;

25 a digital-watermark embedment unit for embedding a digital watermark into a picture obtained as a result of said decoding process carried out by said picture-decoding unit; and

a picture output unit for outputting a picture including said digital-watermark embedded by said digital-watermark embedment unit,

wherein:

said picture-decoding unit carries out a decoding process on an
5 encoded motion vector and an encoded quantization parameter, which are included in said compressed and encoded picture, and outputs a motion vector and a quantization parameter, which are each obtained as a result of said decoding process, to said digital-watermark embedment unit; and

said digital-watermark embedment unit embeds said digital watermark
10 into said picture obtained as a result of said decoding process carried out by said picture-decoding unit on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding unit.

8. A digital-watermark-embedding apparatus for embedding a
15 digital watermark into a content, said digital-watermark-embedding apparatus comprising:

an input unit for inputting an encoded picture as said content;

a picture-decoding unit for carrying out a decoding process on said
encoded picture received from said input unit;

20 a digital-watermark embedment unit for embedding a digital watermark into a picture obtained as a result of said decoding process carried out by said picture-decoding unit; and

a picture compression unit for compressing as well as encoding a
picture including said digital-watermark embedded by said digital-watermark
25 embedment unit and for outputting a compressed and encoded picture including

said embedded digital watermark,

wherein:

said picture-decoding unit carries out a decoding process on an encoded motion vector and an encoded quantization parameter, which are included in said encoded picture, and outputs a motion vector and a quantization parameter, which are each obtained as a result of said decoding process, to said digital-watermark embedment unit and said picture compression unit;

said digital-watermark embedment unit embeds said digital watermark into said picture obtained as a result of said decoding process carried out by said picture-decoding unit on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding unit, and outputs a picture frame including said embedded digital watermark to said picture compression unit; and

said picture compression unit compresses said picture including said digital-watermark embedded by said digital-watermark embedment unit on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding unit.

9. A digital-watermark-embedding apparatus according to claim 7 or 8 wherein, if said input unit receives a compressed and encoded picture including quantization parameters having values spread in accordance with a predetermined distribution, said output picture is a picture including said embedded digital watermark with embedment intensities, which are spread in accordance with a distribution matching said predetermined distribution of said quantization-parameter values.

10. A program to be executed by a computer to carry out functions
of:

a picture input unit for inputting a picture frame;

5 a motion-vector creation unit for creating a motion vector by
comparison of a specific block included in said picture frame received from said
picture input unit with a block included in another picture frame received from
said picture input unit;

a vision-sensitivity computation unit for creating a noise-vision-
10 sensitivity index from a variance of luminance values of said specific block
included in said picture frame;

a digital-watermark embedment unit for embedding a digital watermark
into said picture frame by changing luminance values of each block included in
said picture frame on the basis of said noise-vision-sensitivity index received
15 from said vision-sensitivity computation unit and said motion vector received
from said motion-vector creation unit in order to create a picture frame including
said embedded digital watermark; and

a picture compression unit for creating a quantization parameter on the
basis of said noise-vision-sensitivity index received from said vision-sensitivity
20 computation unit as well as for compressing said picture frame including said
embedded digital watermark on the basis of said quantization parameter and
said motion vector received from said motion-vector creation unit.

11. A program to be executed by a computer to carry out functions
25 of:

an input unit for inputting an encoded and compressed picture frame;
a picture-decoding unit for carrying out a decoding process on said
encoded and compressed picture frame received from said input unit to extract a
motion vector and a quantization parameter from said encoded and compressed
5 picture; and

a digital-watermark embedment unit for embedding a digital watermark
into a picture frame obtained as a result of said decoding process carried out by
said picture-decoding unit on the basis of said quantization parameter and said
motion vector, which are received from said picture-decoding unit.
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12. A program to be executed by a computer to carry out functions
of:

an input unit for inputting an encoded picture frame;
a picture-decoding unit for carrying out a decoding process on said
15 encoded picture frame received from said input unit to extract a motion vector
and a quantization parameter from said encoded picture;
a digital-watermark embedment unit for embedding a digital watermark
into a picture frame obtained as a result of said decoding process carried out by
said picture-decoding unit on the basis of said quantization parameter and said
20 motion vector, which are received from said picture-decoding unit; and
a picture compression unit for compressing a picture including said
digital-watermark embedded by said digital-watermark embedment unit on the
basis of said quantization parameter and said motion vector, which are received
from said picture-decoding unit.

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13. A information-processing system comprising a display unit for displaying an input picture and a storage unit for storing information, said information-processing system comprising:

- a picture input unit for inputting said input picture;
- 5 a motion-searching unit, a vision-sensitivity computation unit and a digital-watermark embedment unit, which are connected to said picture input unit; and
- a picture compression unit connected to said motion-searching unit, said vision-sensitivity computation unit and said digital-watermark embedment
- 10 unit,

wherein:

- said motion-searching unit compares a specific block included in a picture frame received from said picture input unit with a block included in another picture frame received from said picture input unit to create a motion
- 15 vector to be output to said digital-watermark embedment unit and said picture compression unit;
- said vision-sensitivity computation unit creates a noise-vision-sensitivity index from a variance of luminance values of said specific block included in said picture frame received from said picture input unit and outputs said noise-vision-
- 20 sensitivity index to said digital-watermark embedment unit and said picture compression unit;
- said digital-watermark embedment unit embeds a digital watermark into said picture frame by changing luminance values of each block included in said picture frame on the basis of said noise-vision-sensitivity index received from
- 25 said vision-sensitivity computation unit as well as said motion vector received

from said motion-searching unit, and outputs said picture frame including said embedded digital watermark to said picture compression unit; and

5 said picture compression unit creates a quantization parameter on the basis of said noise-vision-sensitivity index received from said vision-sensitivity computation unit, compresses said picture frame including said embedded digital watermark on the basis of said quantization parameter as well as said motion vector received from said motion-searching unit, and outputs said compressed picture frame including said embedded digital watermark to said storage unit.

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14. An information-processing system for inputting a compressed and encoded content and displaying said compressed and encoded content, said information-processing system comprising:

15 an input unit for inputting a compressed and encoded picture as said compressed and encoded content;

 a picture-decoding unit for carrying out a decoding process on said compressed and encoded picture received from said input unit;

20 a digital-watermark embedment unit for embedding a digital watermark into a picture obtained as a result of said decoding process carried out by said picture-decoding unit; and

 a picture output unit for outputting a picture including said digital-watermark embedded by said digital-watermark embedment unit;

 wherein:

25 said picture-decoding unit also carries out a decoding process on an encoded motion vector and an encoded quantization parameter, which are

included in said compressed and encoded picture, and outputs a motion vector and a quantization parameter, which are each obtained as a result of said decoding process, to said digital-watermark embedment unit;

said digital-watermark embedment unit embeds said digital watermark
5 into said picture obtained as a result of said decoding process carried out by said picture-decoding unit on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding unit; and
said display unit displays said picture including said embedded digital watermark.

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15. An information distribution system connected to a network, said information distribution system having:

a picture input unit for inputting an encoded picture from said network;
a picture-decoding unit for carrying out a decoding process on said
15 encoded picture received from said picture input unit;

a digital-watermark embedment unit for embedding a digital watermark into a picture obtained as a result of said decoding process carried out by said picture-decoding unit; and

a picture compression unit for compressing as well as encoding a
20 picture including said digital-watermark embedded by said digital-watermark embedment unit and for outputting a compressed and encoded picture including said embedded digital watermark;

wherein:

said picture-decoding unit also carries out a decoding process on an
25 encoded motion vector and an encoded quantization parameter, which are

included in said encoded picture, and outputs a motion vector and a quantization parameter, which are each obtained as a result of said decoding process, to said digital-watermark embedment unit and said picture compression unit;

5 said digital-watermark embedment unit embeds said digital watermark into said picture obtained as a result of said decoding process carried out by said picture-decoding unit on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding unit, and outputs a picture frame including said embedded digital watermark to said picture compression unit; and

10 said picture compression unit compresses said picture including said digital-watermark embedded by said digital-watermark embedment unit on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding unit, and outputs said compressed picture including said embedded digital watermark to said network.

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16. An integrated circuit for embedding a digital watermark into a content, said integrated circuit comprising:

 a picture input unit for inputting said content;

20 a motion-searching unit, a vision-sensitivity computation unit and a digital-watermark embedment unit, which are connected to said picture input unit; and

 a picture compression unit connected to said motion-searching unit, said vision-sensitivity computation unit and said digital-watermark embedment unit;

25 wherein:

said motion-searching unit compares a specific block included in a picture frame received from said picture input unit with a block included in another picture frame also received from said picture input unit to create a motion vector to be output to said digital-watermark embedment unit and said
5 picture compression unit;

said vision-sensitivity computation unit creates a noise-vision-sensitivity index from a variance of luminance values of said specific block included in said picture frame received from said picture input unit and outputs said noise-vision-sensitivity index to said digital-watermark embedment unit and said picture
10 compression unit;

said digital-watermark embedment unit embeds said digital watermark into said picture frame by changing luminance values of each block included in said picture frame on the basis of said noise-vision-sensitivity index received from said vision-sensitivity computation unit as well as said motion vector
15 received from said motion-searching unit, and outputs said picture frame including said embedded digital watermark to said picture compression unit; and

said picture compression unit creates a quantization parameter on the basis of said noise-vision-sensitivity index received from said vision-sensitivity computation unit, and compresses said picture frame including said embedded
20 digital watermark on the basis of said quantization parameter as well as said motion vector received from said motion-searching unit.

17. An integrated circuit for embedding a digital watermark into a content, said integrated circuit having:

25 an input unit for inputting a compressed and encoded picture as said

content;

a picture-decoding unit for carrying out a decoding process on said compressed and encoded picture received from said input unit;

5 a digital-watermark embedment unit for embedding said digital watermark into a picture obtained as a result of said decoding process carried out by said picture-decoding unit; and

a picture output unit for outputting a picture including said digital-watermark embedded by said digital-watermark embedment unit;

wherein:

10 said picture-decoding unit carries out a decoding process on an encoded motion vector and an encoded quantization parameter, which are included in said compressed and encoded picture, and outputs a motion vector and a quantization parameter, which are each obtained as a result of said decoding process, to said digital-watermark embedment unit; and

15 said digital-watermark embedment unit embeds said digital watermark into said picture obtained as a result of said decoding process carried out by said picture-decoding unit on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding unit.

20 18. An integrated circuit for embedding a digital watermark into a content, said integrated circuit having:

a picture input unit for inputting an encoded picture as said content;

a picture-decoding unit for carrying out a decoding process on said encoded picture received from said picture input unit;

25 a digital-watermark embedment unit for embedding said digital

watermark into a picture obtained as a result of said decoding process carried out by said picture-decoding unit; and

a picture compression unit for compressing as well as encoding a picture including said digital-watermark embedded by said digital-watermark embedment unit,

wherein:

said picture-decoding unit also carries out a decoding process on an encoded motion vector and an encoded quantization parameter, which are included in said encoded picture, and outputs a motion vector and a quantization parameter, which are each obtained as a result of said decoding process, to said digital-watermark embedment unit and said picture compression unit;

said digital-watermark embedment unit embeds said digital watermark into said picture obtained as a result of said decoding process carried out by said picture-decoding unit on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding unit; and

said picture compression unit compresses said picture including said digital-watermark embedded by said digital-watermark embedment unit on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding unit.

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19. A digital-watermark-embedding method of embedding a digital watermark into a content, said digital-watermark-embedding method comprising:

a picture input process of inputting said content;

a frame extraction process of extracting a picture frame from said

content input in said picture input process and outputting said picture frame to a

motion-searching unit, a vision-sensitivity computation unit and a digital-watermark embedment unit;

a motion-vector creation process of, by use of said motion-searching unit, comparing a specific block included in said picture frame received from said frame extraction process with a block included in another picture frame received from said frame extraction process to create a motion vector to be output to said digital-watermark embedment unit and a picture compression unit;

a vision-sensitivity computation process of, by use of said vision-sensitivity computation unit, creating a noise-vision-sensitivity index from a variance of luminance values of said specific block included in said picture frame received from said frame extraction process and outputting said noise-vision-sensitivity index to said digital-watermark embedment unit and said picture compression unit;

a digital-watermark process of, by use of said digital-watermark embedment unit, embedding said digital watermark into said picture frame by changing luminance values of each block included in said picture frame on the basis of said noise-vision-sensitivity index received from said vision-sensitivity computation process as well as said motion vector received from said motion-vector creation process, and outputting said picture frame including said embedded digital watermark to said picture compression unit; and

a picture compression process of, by use of said picture compression unit, creating a quantization parameter on the basis of said noise-vision-sensitivity index received from said vision-sensitivity computation process, and compressing said picture frame including said embedded digital watermark on the basis of said quantization parameter as well as said motion vector received

from said motion-vector creation process.

20. A digital-watermark-embedding method of embedding a digital watermark into a content, said digital-watermark-embedding method comprising:

5 a picture input process of inputting a compressed and encoded picture as said content;

a picture-decoding process of, by use of a picture-decoding unit, carrying out a decoding operation on said compressed and encoded picture received from said picture input process as well as on an encoded motion vector
10 and an encoded quantization parameter, which are included in said compressed and encoded picture, and outputting a motion vector and a quantization parameter, which are each obtained as a result of said decoding operation, to a digital-watermark embedment unit; and

a digital-watermark-embedding process of, by use of said digital-
15 watermark embedment unit, embedding said digital watermark into a picture obtained as a result of said decoding operation carried out in said picture-decoding process on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding process.

20 21. A digital-watermark-embedding method of embedding a digital watermark into a content, said digital-watermark-embedding method comprising:

a picture input process of inputting an encoded picture as said content;

a picture-decoding process of, by use of a picture-decoding unit, carrying out a decoding operation on said encoded picture received from said
25 picture input process as well as on an encoded motion vector and an encoded

quantization parameter, which are included in said encoded picture, and outputting a motion vector and a quantization parameter, which are each obtained as a result of said decoding operation, to a digital-watermark embedment unit as well as a picture compression unit; and

5 a digital-watermark-embedding process of, by use of said digital-watermark embedment unit, embedding said digital watermark into a picture obtained as a result of said decoding operation carried out in said picture-decoding process on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding process; and

10 a frame compression process of, by use of said picture compression unit, compressing a picture including said digital-watermark embedded in said digital-watermark-embedding process on the basis of said motion vector and said quantization parameter, which are received from said picture-decoding process.